At step S201, the reconstructed top or bottom field block is sequentially received and, at step S203, exterior pixels in the reconstructed top or bottom field block are eliminated based on the shape information, wherein the exterior pixels are located at the outside of the contour for the object. The reconstructed shape information may be used on behalf of the shape information. While the exterior pixels are eliminated to be set as transparent pixels, i.e., undefined texture pixels, the remaining interior pixels in the reconstructed top or bottom field block are provided as defined texture pixels on a field block-by-field block basis.

At step S204, each reconstructed block having a reconstructed top and its corresponding reconstructed bottom field blocks is determined whether or not being traversed by the contour of the object. In other words, each reconstructed block is determined as an interior block, a boundary block, or an exterior block, wherein the interior block has only the defined texture pixels, the exterior block has only the undefined texture pixels and the boundary block has both the defined texture pixels and the undefined texture pixels. If the reconstructed block is determined as an interior block, at step S210, no padding is performed and the process goes to step S208.

If the reconstructed block is a boundary block BB as shown in FIG. 3A, at steps S221 to S224, the undefined texture pixels of the boundary block are extrapolated from the defined texture pixels thereof to generate an extrapolated boundary block, wherein each of squares is a texture pixel, each shaded square being a defined texture pixel and each white one being a undefined texture pixel.

First, at step S221, the boundary block is divided into a top and a bottom boundary field blocks T and B as shown in FIG. 3B, wherein each boundary field block has M/2×N texture pixels, i.e., 8×16 texture pixels so that the top and the bottom field blocks T and B have M/2, i.e., 8 rows T1 to T8 and B1 to B8, respectively.

At step S222, the undefined texture pixels are padded on a row-by-row basis by using a horizontal repetitive padding technique as shown in FIG. 3C to generate a padded row for each of rows B1, B2 and B4 to B8. In other words, the undefined texture pixels are filled by repeating boundary pixels toward the arrows as shown in FIG. 3C, wherein each boundary pixel among the defined texture pixels is located on the contour, i.e., the border, of the object. If there exist undefined texture pixels which may be padded by the repetition of more than one boundary pixel, the average value of the repeated values is used.

If there exist one or more transparent rows, having the undefined texture pixels only, on each top or bottom field block, at step S223, each transparent row is padded by using one or more nearest defined or padded rows among the corresponding top or bottom field block, wherein the defined row has all the defined texture pixels therein. For example, as shown in FIG. 3D, each undefined texture pixel of the transparent row B3 shown in the bottom field block is padded with an average of two defined or padded texture pixels based on a nearest upward and a nearest downward padded rows, i.e., the 2nd and the 4th padded rows B2 and B4 in the bottom field block B. If the transparent row is located at the highest or the lowest row, i.e., corresponds to the 1st row 1 or the 8th row, each texture pixel is padded with a defined or padded texture pixel of the nearest padded or defined row.

If there exists one transparent boundary field block in the boundary block as shown in FIG. 3B, at step S224, the transparent boundary field block is padded based on the other boundary field block of the boundary block, wherein the transparent boundary field block, i.e., an undefined field block has no defined texture pixel therein. In other words, if a top field block is transparent, all the undefined texture pixels thereof may be padded with a constant value P as shown in FIG. 3E, e.g., a mean value of the defined texture pixels within the bottom field block. The mean value of both the defined and the padded pixels within the bottom field block can also be used to fill the transparent field block. If necessary, a middle value 2_{L-1} of all the possible values for any texture pixel may be used based on the channel characteristics, wherein L is the number of bits assigned for each pixel. For example, if L is equal to 8, there are 256 texture pixels 0 to 255 and the middle value is determined to be 128.

After all the interior and boundary blocks are padded as described above, in order to cope with a VOP of fast motion, the padding must be further extended to undefined adjacent blocks, i.e., exterior blocks which are adjacent to one or more interior or boundary blocks. The adjacent blocks can stretch outside the VOP, if necessary. At step S208, the undefined texture pixels in the undefined adjacent block are padded based on one of the extrapolated boundary blocks and the interior blocks to generate an extrapolated adjacent block for the undefined adjacent block, wherein each extrapolated boundary block has a part of the contour A of an object and each undefined adjacent block is shown as a shaded region as shown in FIG. 4. If more than one extrapolated boundary blocks surround the undefined adjacent block, one of the left, the upper, the right and the below extrapolated boundary blocks of the undefined adjacent block is selected in this priority and, then, a vertical or a horizontal border of the selected extrapolated boundary block is repeated rightwards, downwards, leftwards or upwards, wherein the vertical or the horizontal border adjoins the undefined adjacent block. As shown in FIG. 4, the undefined adjacent blocks JB4, JB10, JB15, JB21 and JB28 select their respective left extrapolated boundary blocks a2, a5, a9, a13 and a14; the undefined adjacent blocks JB20, JB27 and JB22 select their respective upper extrapolated boundary blocks a10, a14 and a13; the undefined adjacent blocks JB1, JB9, JB14 and JB19 select their respective right extrapolated boundary blocks a1, a3, a6 and a10; and the undefined adjacent blocks JB2 and JB3 select their respective below extrapolated boundary blocks a1 and a2. A rightmost vertical border of the extrapolated boundary block a2 is expanded rightward to fill the undefined adjacent block JB4, a lowermost horizontal border of the extrapolated boundary block a10 is expanded downward to fill the undefined adjacent block JB20 and so on. Also, undefined diagonal blocks such as M1, M2, MS and M7 to M11 may be padded with a constant value, e.g., '128' to be the extrapolated adjacent block for the undefined diagonal block, wherein each undefined diagonal block is diagonally adjacent to the extrapolated boundary block and has all undefined texture pixels.

As described above, at step S211, the extrapolated boundary and the extrapolated adjacent blocks as well as the interior blocks are stored.

While the present invention has been described with respect to the particular embodiments, it will be apparent to those skilled in the art that various changes and modifications may be made without departing from the spirit and scope of the invention as defined in the following claims.

What is claimed is:

1. A method for encoding interlaced texture information on a texture macroblock basis through a motion estimation between a current VOP and its one or more reference VOP's, wherein each texture macroblock of the current and the reference VOP's has M×N defined or undefined texture pixels, M and N being positive even integers, respectively, the method comprising the steps of:

(a) detecting whether said each texture macroblock of each reference VOP is a boundary block or not, wherein

the boundary block has at least one defined texture pixel and at least one undefined texture pixel;

(b) dividing the boundary block into two field blocks, each field block having M/2×N texture pixels;

(c) extrapolating the undefined texture pixels of each field block based on the defined texture pixels thereof to generate an extrapolated boundary block for said two field blocks;

(d) if the boundary block has an undefined field block and a defined field block, padding the undefined field block based on the defined field block, wherein the undefined field block and the defined field block represent one field block having the undefined texture pixels only and the other field block having at least one defined texture pixel, respectively; and

(f) expanding an undefined adjacent block based on the extrapolated boundary block, wherein the undefined adjacent block is adjacent to the extrapolated boundary block and has only undefined texture pixels,

wherein the step (c) further includes the step of (c1) field-padding said at least one undefined texture pixel in a field block from said at least one defined texture pixel therein, to thereby generate a padded field block for the field block,

wherein the step (c1) has the steps of:

(c11) row-padding said at least one undefined texture pixel on a row-by-row basis to generate a padded row; and

(c12) padding, if there exists a transparent row, the transparent row from at least one nearest padded row, wherein the transparent row represents a row having the undefined texture pixels only.

2. The method as recited in claim **1**, wherein said step (f) includes the steps of:

(f1) selecting, if said undefined adjacent block is surrounded by a plurality of extrapolated boundary blocks, one of the left, the upper, the right and the below extrapolated boundary blocks of said undefined adjacent block in this priority; and

(f2) replicating a vertical or a horizontal border of the selected extrapolated boundary block rightwards, downwards, leftwards or upwards, to thereby expand the undefined adjacent block, wherein the vertical or the horizontal border adjoins said undefined adjacent block.

3. The method as recited in claim **1**, wherein all the undefined texture pixels of said undefined field block are padded with a constant value.

4. The method as recited in claim **3**, wherein all the undefined texture pixels of said undefined field block are padded with a mean value of both the defined texture pixels and padded texture pixels within the padded field block for the other field block, wherein the padded texture pixels are field-padded through the step (c1).

5. The method as recited in claim **3**, wherein all the undefined texture pixels of said undefined field block are padded with a mean value of the defined texture pixels within the padded field block for the other field block.

6. The method as recited in claim **3**, wherein the constant value is 2^{L-1}, wherein L is the number of bits assigned for each pixel.

7. The method as recited in claim **6**, wherein L is 8.

8. An apparatus for encoding interlaced texture information on a texture macroblock basis through a motion estimation between a current VOP and its one or more reference VOP's, wherein each texture macroblock of the current and reference VOP's has M×N texture pixels, M and N being positive even integers, respectively, the apparatus comprising:

a boundary block detector for detecting whether said each texture macroblock of each reference VOP is a boundary block or not, wherein the boundary block has at least one defined texture pixel and at least one undefined texture pixel;

a field divider for dividing the boundary block into two field blocks, each field block having M/2×N texture pixels;

a texture pixel padding circuit for extrapolating the undefined texture pixels of each field block based on the defined texture pixels thereof to generate an extrapolated boundary block for said two field blocks;

a transparent field padding circuit for padding an undefined field block of the boundary block based on the other field block thereof, wherein the undefined field block represents a field block having the undefined texture pixels only;

an adjacent block padding circuit for expanding an undefined adjacent block based on the extrapolated boundary block, wherein the undefined adjacent block is adjacent to the extrapolated boundary block and has the undefined texture pixels only; and

a field-padding circuit for field-padding the undefined texture pixels in a field block from the defined texture pixels therein, to thereby generate a padded field block for the field block, wherein the field-padding circuit includes:

a horizontal padding circuit for padding the undefined texture pixels on a row-by-row basis to generate a padded row; and

a transparent row padding circuit for padding the transparent row from at least one nearest padded row, wherein the transparent row represents a row having the defined texture pixels only.

9. The apparatus as recited in claim **8**, wherein said adjacent block padding circuit includes:

a selector for selecting one of the left, the upper, the right and the below extrapolated boundary blocks of said undefined adjacent block in this priority; and

means for replicating a vertical or a horizontal border of the selected extrapolated boundary block rightwards, downwards, leftwards or upwards, to thereby expand the undefined adjacent block, wherein the vertical or the horizontal border adjoins said undefined adjacent block.

10. The apparatus as recited in claim **8**, wherein all the undefined texture pixels of said undefined field block are padded with a constant value.

11. The apparatus as recited in claim **10**, wherein all the undefined texture pixels of said undefined field block are padded with a mean value of both the defined texture pixels and padded texture pixels within the padded field block for the other field block, wherein the padded texture pixels are field-padded through the field-padding circuit.

12. The apparatus as recited in claim **10**, wherein all the undefined texture pixels of said undefined field block are padded with a mean value of the defined texture pixels within the padded field block for the other field block.

13. The apparatus as recited in claim **10**, wherein the constant value is 2^{L-1}, L being the number of bits assigned for each pixel.

14. The apparatus as recited in claim **13**, wherein L is 8.

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